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Sertifikaat

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Certificate

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DEPARTMENT OF TRADE AND
INDUSTRY

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REC'D 05 JUL 2004
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the documents annexed hereto are true copies of:

Application forms P.1, P2, provisional specification and drawings of South African Patent Application No. 2002/9973 as originally filed in the Republic of South Africa on 10 December 2002 and postdated to 24 December 2002 and also postdated to 24 January 2003 in the name of ALMAR PACKAGING SOLUTIONS (PTY) LTD for invention entitled: "ROTOR MOULDING MACHINE."

ken te **PRETORIA** in die Republiek van Suid-Afrika, hierdie 4th dag van **May 2004**
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PATENTS ACT, 1978

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Form P 1

APPLICATION FOR A P[illegible] NT OF RECEIPT

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Revenue stamps or revenue franking machine impression
Official date stamp

The grant of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate.

Official Application No.
21 01 : 2002/9973

(i)
Applicant's or agent's reference
AANSOEKERS VERVANG

(ii)
71 Full name(s) of applicant(s) ..... APPLICANTS SUBSTITUTED
ALMAR PACKAGING SOLUTIONS (PTY) LTD
WOOD. RICHARD ROY.

(iii)
Address(es) of applicant(s) .....
13 JACK STREET 201 Gateway 3 Sugar Close Umhlanga 4320
ROSLYN HILLS KWAZULU.

(iv)
54 Title of invention ROTOR MOORDING MACHINE.

(v)
The applicant claims priority as set out on the accompanying form P 2.

(vi)
This application is for a patent of addition to Patient Application No.
61 01

(vii)
This application is a fresh application in terms of section 37 and based on Application No.
62 01

(viii)
This application is accompanied by:

✓	1.	A single copy of a provisional or two copies of a complete specification of 9 pages.
✓	2.	Drawings of 9 sheets.
	3.	Publication particulars and abstract (form P 8 in duplicate).
	4.	A copy of Figure ..... of drawings (if any) for the abstract.
	5.	An assignment of invention.
	6.	Certified priority document(s) (state number).
	7.	Translation of the priority document(s).
	8.	An assignment of priority rights.
	9.	A copy of the form P 2 and the specification of S.A. Patent Application No. 21 01
✓	10.	A declaration and Power of Attorney on form P 3.
	11.	Request for ante-dating on form P 4.
	12.	Request for classification on form P 9.
	13.	

(ix)
74 Address for service: McCALLUM RADEMEYER & FREIMOND P.O.Box 607 HARRISBURG 1700.

Dated this 10TH day of DECEMBER 2002.

.....
Signature of applicant(s) or agent

The duplicate will be returned to the applicant's address for service as proof of lodging but is not valid unless endorsed with official stamp.

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G.P.-S. 019-0194

FORM P 2
(To be lodged in duplicate)

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PATENTS ACT, 1978

24-01-2003

REGISTER OF PATENTS

Official application No.	Lodging date: Provisional	Acceptance date
21 2002/9973	22 ~~Pat dated 24.12.02~~ ~~2002-12-10~~	47
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51	23 ~~2002-12-13~~	

Full name(s) of applicant(s)/Patentee(s):

71 ~~WOOD~~ RICHARD ~~ROY~~.

WOOD RICHARD ROY.

AANSOEKERS VERVANG

Applicants substituted: APPLICANTS SUBSTITUTED	Date registered
71 ALMAR PACKAGING SOLUTIONS (PTY) LTD	30.05.2003.

Assignee(s):	Date registered
71	

Full name(s) of inventor(s):

72 WOOD. RICHARD. ROY.

Priority claimed	Country	Number	Date
	33	31	32
	33	31	32
	33	31	32

Title of Invention

54 ROTOR MOULDING MACHINE.

Address of applicant(s)/Patentee(s): ~~13 JACK STREET ROBIN HILLS~~ 2001 Oakview, 3 Sugar Close Umhlanga 4320 RANDBURG.

Address for service: 74 McCALLUM RADEMEYER & FREIMOND ~~P.O. BOX 607 MARAIS BURG 1700~~.

Patent of addition No.	Date of any change
61	

Fresh application based on	Date of any change

P 015 (E)

Form P6

REPUBLIC OF SOUTH AFRICA

PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) - Regulation 27)

Official Application No.		
21	01	2002/9973

Lodging Date	
22	Post dated 2002-12-10 ~~24-12-2002~~ 24-01-2003

AANSOEKERS VERVANG
APPLICANTS SUBSTITUTED

Full name(s) of applicant(s)
71 ~~WOOD, RICHARD ROY.~~ ALMAR PACKAGING SOLUTIONS (PTY) LTD

Full name(s) of inventors(s)
72 WOOD, RICHARD ROY.

Title of invention
54 ROTOR MOULDING MACHINE.

(RP42E)

FIELD OF THE INVENTION

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The process of roto moulding plastics is well known.

In essence a split mould is filled with a pre weighed amount of ground linear low density polyethylene powder.

The mould is then manipulated so that it tumbles in all three axes inside a heating oven.

The warming of the mould causes a thin layer of plastic powder to stick to the inner surface of the mould. Due to the random tumbling of the mould the plastic continues to build up and create an even plastic wall thickness until all the powder has been distributed.

At this point the still tumbling mould is removed from the heating oven and is placed in a cold air stream which cools down the entire mould plus plastic and once sufficient cooling time has elapsed to render the plastic sensibly ridged, the tumbling is stopped and the mould is split open and the hollow plastic component is removed from the mould.

BACKGROUND TO THE INVENTION

Rotational moulders are well known.
The general configuration of a multi arm rotor moulding machine has one arm in a heating zone, one arm in a cooling zone and a third arm in a stripping and reloading zone.
This allows for a continuous sequence of operation.
Some of the disadvantages of known machines are as follows:

1. Each arm has a dual drive function, which is often co-axial and whilst the outer arm rotates one axis, internal bevel gears or chain drive trains operate through the centre of the arm. These mechanisms are subject to extremely high torque loads and subsequently high wear rates, as large moulds are rotationally driven from the centre by a small torque arm. The longer the torque arm the less stress in the mechanism the shorter the torque arm the greater the stress.

2. The arms are supported on bearings on one end and cantilever with the full mass of the rotating head plus loaded moulds at the other end. This overhung design creates high cyclic stress reversals due to the rotation and therefore the mechanisms are prone to fatigue failure.

3. When a high stripping force is required the overhung arm is easily damaged due to it's lack of rigidity.

4. A machine of this design generally use up a large amount of floor space.

5. Safety with respect to moving machinery becomes an issue.

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6. The heating ovens generally have two doors, which open to allow the arm to swing through or sliding doors are provided which allow the entire oven to be retracted in a radial direction away from the arm and moulds this uses still more floor space.
Either way a large amount of the heat in the oven is lost to atmosphere when the doors are open.

7. Most ovens of the above type, due to their box type shape have a volume far in excess of what is required which drastically reduces thermal efficiency.

8. Cooling stations are very often simply banks of fans which blow air onto the rotating moulds. The resultant hot air is not directed away in any form and so heat up the general environment.

SUMMARY OF THE INVENTION

1. A mould manipulator according to the invention comprises;

   (a) A rotor moulding frame
   (b) A mould mounting arrangement which is rotatably mounted to the frame (a) for rotation about a first axis.
   (c) Means for rotating the frame (a) about a second axis which is normal to the first axis.
   (d) Means for concomitantly rotating the frame (a) and the mould mount arrangement (b) in opposite directions of rotation.
   (e) And drive means for rotating the frame.

2. A carousel according to the invention comprises :-

   (a) Means to indexably support a plurality of manipulators about a centre of rotation.
   (b) Means to anchor the carousel to the floor against vertical stripping forces.

3. A heating and cooling assembly according to the invention comprises :-

   (a) A dome topped open bottomed top hat heating furnace.
   (b) A ducted cooling fan shroud
   (c) Means to rigidly connect "a" and "b" into a single vertically moveable unit.
   (d) Means to raise and lower the heating and cooling shroud assembly.
   (e) Means to drive the manipulator within the heating and cooling stations.

BRIEF DESCRIPTION OF DRAWINGS

An embodiment of the invention is now described by way of example only with reference to drawings in which:

Fig 1. Is a perspective view of one of three two axis manipulation stations, onto which a plurality of moulds may be mounted. It also shows the axes of rotation.

Fig 2. Is the same view showing four component moulds mounted in the manipulator

Fig 3. Is a view along the horizontal axis of the manipulator from the drive end, showing the four component moulds in position to be tumbled.

Fig 3a Is a similar view showing the driven ring gear orbit.

Fig 4. Is a perspective view of a carousal framework which is supported on nine wheels so that the carousal can freely rotate about it's centre, and a lifting gantry which includes a geared motor which rotates a transverse shaft which is supported between the two upright members.

Fig 5. Is a heating and cooling assembly perspective view of the proposed heating with a hemispherical top and the air cooling shroud as well as two geared motors with rubber tyred capstan drive wheels which are mounted to the end of a swing frame.

Fig 6. Is a planned view of the assembled machine showing three manipulator stations including moulds assembled to the carousel at 120 degree spacings and the heating and cooling assembly dropped into position guided by the two gantry upright members to be in register with two of the three manipulator stations. It also shows the capstan drive wheels in contact with the friction drive wheels of the two manipulators.

Fig 7. Is a side view of the machine with the heating and cooling assembly in a raised position with the moulds stationary in the stripping station.

Fig 8. Is a similar side view of the machine with the heating and cooling assembly in the lowered position showing the moulds removed for stripping and reloading with powder. This view also shows that the rubber capstan wheels are in frictional contact with the driven wheels of the manipulators.

DETAILED DESCRIPTION OF THE DRAWINGS

TWO AXIS MANIPULATOR

The operation of the two axis manipulator is explained with reference to figure 1.

Two semi circular base members 1 are bolted together by two angles 2 back to back to forma circular base which includes a "U" shaped peripheral rim 3 with two cross support "U" members 4 as shown.

The entire underside of the ring is covered with sheet metal which forms pockets 5 and 6 which accept insulation material to form the insulated floor of the manipulator station.

Vertical support members 7,8 & 9 are bolted to the cross members 4 and each carry a bearing 10 as shown along horizontal axis H-H.

Support members 8 & 9 are braced for lateral stiffness by cross plate 11.

Support member 9 is shaped to have tapered sides and half round top. It carries around it's edge a flat strip of metal 12 which seals against a similar strip along the edge of a like shaped aperture in the walls of the heating oven and cooling shroud in use.

A bevel ring gear 13 is attached to vertical A frame member 8 by three adjustable support pillars 14 as shown.

A rectangular frame structure 15 has shown has a stub shaft 16 at one end and a longer drive shaft 17 at the other end.

The rotor frame assembly 18 is rotationally supported along the H- axis by the three bearings 10 as shown and carries at the extreme end of it's drive shaft a friction drive wheel, which derives it's drive from frictional contact with the drive capstan wheel 20 as shown.

A second shaft 21 along the V – V axis is supported to be normal to the axis H-H between two bearings 22 as shown.

The shaft 21 is square in section and has a stub shaft at one end and a longer drive shaft at the other end, which carries a bevel ring gear wheel 23 which is in mesh with fixed ring gear 13.

All moulds are supported by structures which attach to square shaft 21.

Plate 24 on one side of the rotor frame is 6mm thick but plate 25 on the opposite side of the rotor frame is 25mm thick, this is to compensate of the mass of the driven bevel ring gear wheel 23, and facilitates balancing the assembly when it is rotating. Additional ballast can be in the form of round bar placed in position 26 until perfect balancing is achieved.

In use when capstan wheel 20 is rotated anti clockwise by a geared motor the friction drive wheel 19 is caused to rotate in a clockwise direction and hence the entire rotor frame assembly rotates clockwise.

Due to fixed bevel ring gear 13 being in mesh with bevel ring gear wheel 23 the clockwise rotation of rotor frame assembly 18 causes shaft 21 on the V-V axis to rotate in an anti clockwise direction as ring gear 23 orbits around fixed ring gear 13.

CAROUSEL AND LIFTING GANTRY

The operating of the carousel and lifting gantry is explained with reference to figure 4.

Nine base wheel assemblies 10 are bolted to the floor in the positions shown i.e. in groups of three spaced at 120 degrees around the centre 8.
Each wheel axle includes an eccentric section which allows all 9 wheels to be set to exactly the same level.

Three carousel fabricated members 1 are bolted together at interface 2 to form a complete carousal generally 5.

The carousel 5 rests on the 9 wheels 10 and is free to rotate about its centre 8.
It is prevented from derailment by an internal lip 4 which holds the carousel concentric to centre 8 during rotation.

Each segment 1 carries two rollers 7 one internal and one external midway between the two interfaces 2 as shown.

Further, to hold down brackets 9 are bolted to the floor as shown at a position 11 which is normal to a line through the gantry upright members 12.

In use when the carousel is stopped at position 11, which is the stripping station of the machine then the two rollers 7 are in register with the cantilever portions of the hold down brackets 9 and therefore a lifting force can be applied to the carousel during stripping and the carousel will be restrained from lifting.

Still further two gantry vertical members 12 are bolted to the floor in position as shown.

Each upright member 12 carries a bearing 13 with the axis horizontal which support transverse shaft 16.

Two triplex chain sprockets 15 are keyed to the shaft 16 in the positions shown and the shaft is driven by geared motor 14 which includes an anti run back break.

HEATING OVEN AND COOLING SHROUD ASSEMBLY

With reference to figure 5 the heating oven and cooling shroud assembly is now explained.

Heating oven generally 1 and cooling shroud generally 2 is supported within two octagonal frame structures 3 & 4 as shown which are bolted together by frame 5 shown and frame 6 not shown to form a single rigid member, which can be raised and lowered by attachment of a triplex roller chain to each of the two chain link attachment fittings 7 as shown.

Four flanged rollers 8 at each end of the assembly run within the confines of the vertical flanges of the upright members 12 in figure 4.

The oven has a hemispherical top as shown and is either heated electrically or by gas or oil fired burner.

The oven has an open bottom and all surfaces are insulated and includes a cut out portion which aligns with support member 9 in figure 1 in use.

The cooling shroud is open top and bottom and includes three fans 9 as shown which are directed inward and slightly upward the cooling shroud also includes a cut out portion which aligns with support member 9 in figure 1 in use.

Further, frame 5 carries at it's top as shown two bosses 10 to which swing frame 11 is pivotally attached. The free end of the swing arm 11 includes a bracket 12 which carries two geared motors 13 which drive tyred capstan wheels 14

When the heating and cooling assembly is raised the swing arm is restrained from swinging too far down by its contact with the top of frame 3 & 4.

ASSEMBLY OF THE COMPLETE MACHINE

With reference to figure 6 the complete machine is now explained.

Consider that in the plan view of figure 6, hold down bracket 1 indicates the home position of the stripping and refilling station generally 2 as shown.

Then three manipulator stations including moulds as per figure 2 are bolted to the carousal at 120-degree spacings as shown with all three-drive wheels facing inward.

The complete heating and cooling shroud assembly as per figure 5 is then assembled so that the heating oven is in register with heating station generally 4 and the cooling shroud in register with cooling station generally 5.

METHOD OF ROTOR MOULDING

A method of rotor moulding according to the invention may include the following steps refer figure 3.

Consider that all the moulds in the machine are empty except for the moulds in station 2 which are filled with plastic powder and the machine is cold.

1. On start up the heating and cooling assembly will immediately start raising until it reaches it's top position.

2. The top position sensor initiates the carousel rotation mechanism to turn the carousal 120 degrees anti-clockwise which places the filled moulds in register below the heating oven.

3. When the 120-degree movement is complete a sensor initiates the lowering of the heating and cooling assembly.

4. When the assembly is fully down a sensor initiates the start of the heating cycle in the oven and the gear motors of the capstan wheels start driving the manipulators in stations 4 & 5 as well as the three fans in the cooling shroud.

5. Both manipulators are able to rotate, stop and reverse direction periodically throughout the operation.

6. The moulds in station two which is not driven and is therefore safe to work on are unloaded by using quick release clamps and are removed by an overhead jib crane and replaced with new moulds filled with powder.

7. When all four moulds have been replaced within station 2 a "Ready To Proceed" button is pressed. This tells the program that once the heating cycle is complete the program can continue.

8. A thermostat in the oven controls the temperature until the full time of the heating cycle has elapsed.

9. When the heating cycle is finished the thermostat switches the heat input to "Low" and the heating and cooling assembly is raised to the top position.
The capstan drive wheels automatically lift away from the drive wheels 3 as the assembly is raised.

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10. The top position sensor initiates the carousel rotator mechanism to index the carousel 120 degrees anti-clockwise and it also tells the drive capstans to stop.

11. When the 120 degree movement is complete a sensor initiates the lowering of the heating and cooling assembly.

12. When the assembly is fully down a sensor indicates that the heating goes to "High", the fans in the cooling shroud start up and the capstan drive wheels start rotating the manipulators.

13. Recharged moulds are then fitted to the stripping station manipulator and the "Ready To Proceed" button is pressed.

14. We now await the timeout of the next heating cycle. During this period the moulds are stripped and refilled with powder and returned to the machine timeously.

15. After the next heating cycle is complete and all the steps have been repeated, from then on the machine runs continuously i.e. at any one time there is one station being loaded and unloaded, one station being heated and one station being cooled and the whole cycle is regulated by the length of the heating cycle.

BENEFITS OF THE MACHINE OF THE INVENTION

It is important to note that to overcome the problems mentioned in the preamble to this specification in connection with prior art roto moulding machine techniques, it is apparent from what is disclosed above that :-

a) The heating oven is very efficient from a heat loss on change over point of view as no doors are opened and all the heat which rises is trapped within the dome of the oven

b) There are no overhung or cantilevered components in the manipulator. All shafts are supported between bearings, therefore no cyclic stress reversals take place and there is accordingly less propensity for fatigue failure.

c) The machine of the invention provides for holding down the base member or carousel against the sometimes robust forces of stripping vertically.

d) The large diameter bevelled gear wheels provide for extremely low torque loads when rotating.

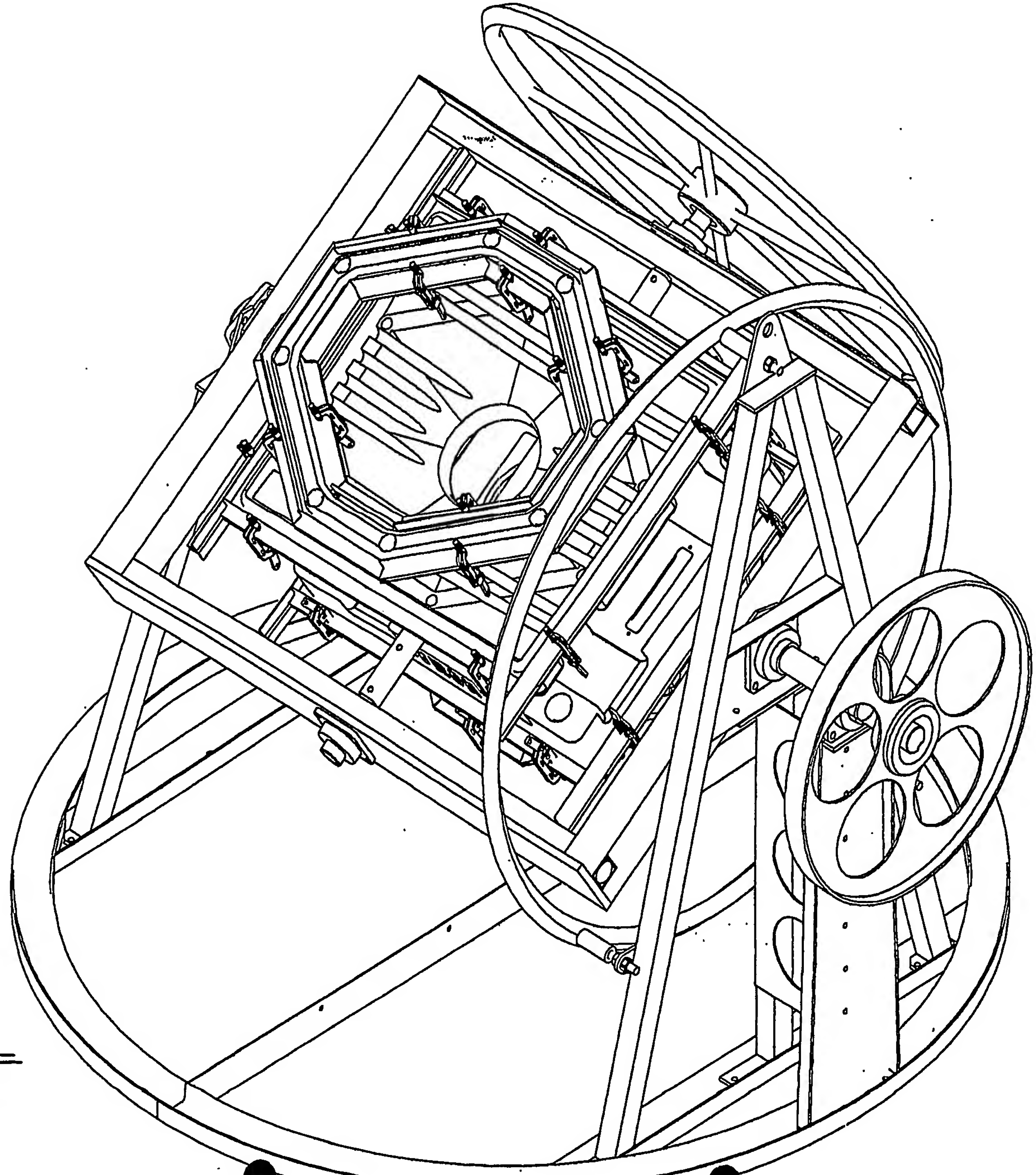
e) The cooling shroud provides for directed cooling which is more efficient.

f) Many operator safety aspects are designed into the machine of the invention in that no moving parts are exposed and less likelihood of an accident exists.

g) Due to the ease of changing moulds in the stripping station, this activity which is generally the longest in the chain of events no longer is a bottle neck and so the heating cycle can be optimised.

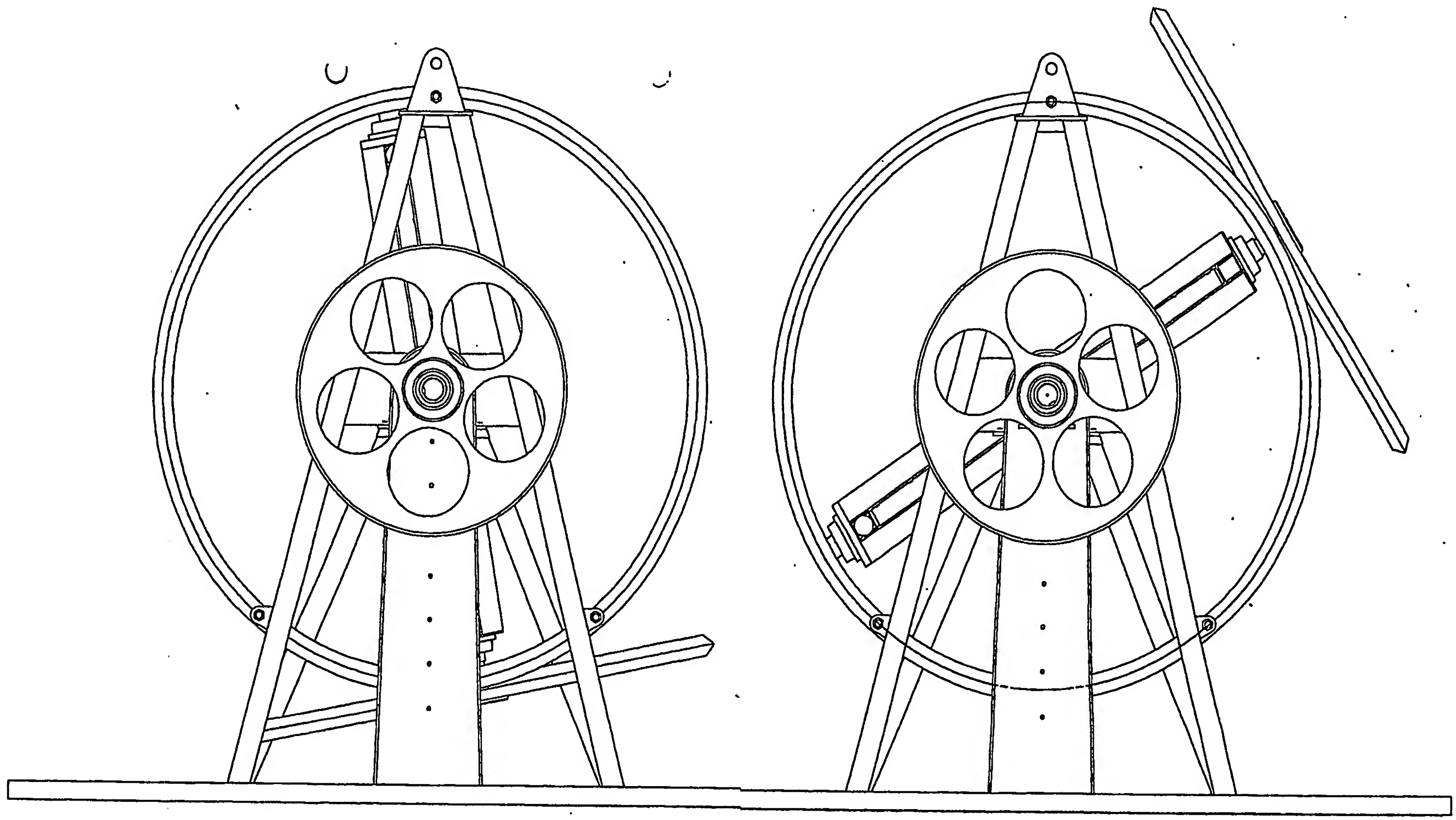
h) The compact design of the machine of the invention means that far less factory floor space is employed.

Fig II



=FIG 2=

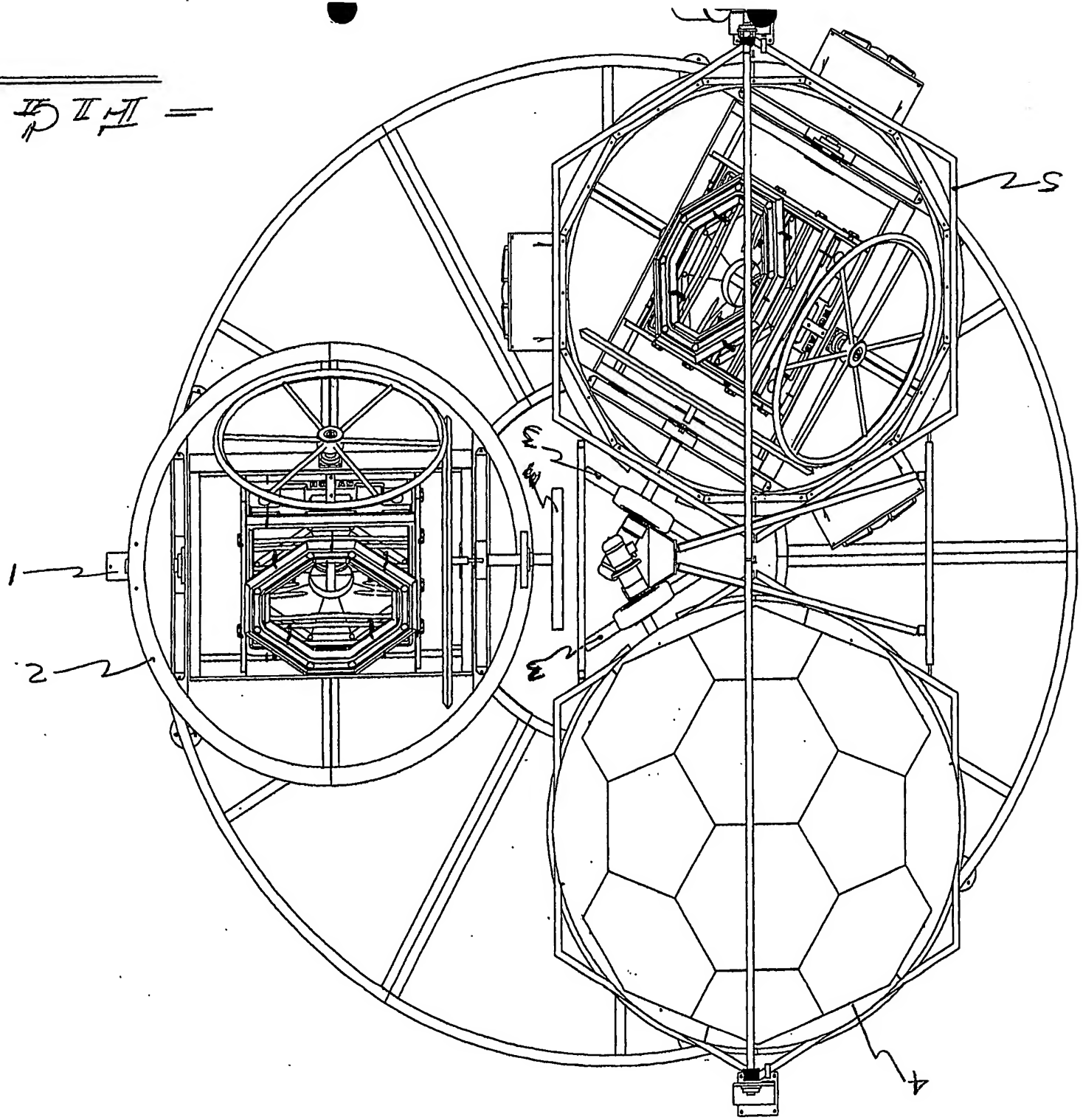
Fig 3



=FIG 3A=

FIG. 4

FIG 5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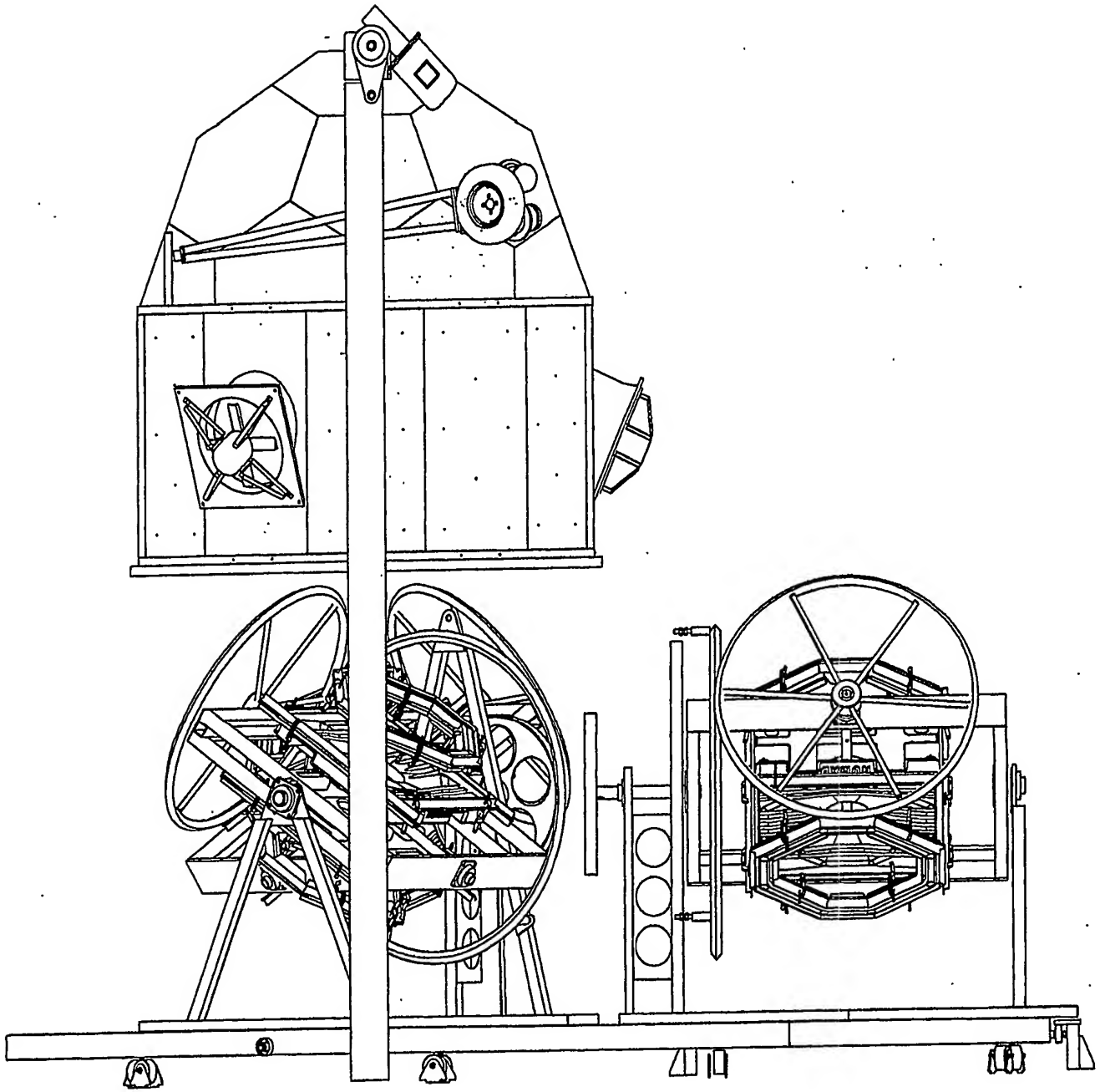

= FIG 7 =

Fig 8